REMARKS

Claim Rejections – 35 U.S.C. § 112, First Paragraph

The Examiner has rejected claim 2 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The Examiner has rejected claim 2 in that he believes that there does not appear to be a written description for the limitation "***wherein said dielectric layer is exposed to said electrically neutral reactive oxygen atoms at a second temperature which is less than said first temperature***." Applicant respectfully disagrees. Support for said limitation can be found at least on page 20, lines 21-24. As such, Applicant respectfully requests the removal of the 35 U.S.C. § 112, first paragraph rejections of claim 2.

Claim Rejections – 35 U.S.C. § 112, Second Paragraph

The Examiner has rejected claims 1-7 and 14-23 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant has amended 1-7 and 14-23 to more particularly point out and distinctly claim the subject matter of the present invention. According, Applicant respectfully requests the removal of the 35 U.S.C. § 112, second paragraph rejections of claims 1-7 and 14-23.

Claim Rejections – 35 U.S.C. § 103

The Examiner has rejected claims 1, 2, 4-6, 14, 17, 18 and 21-23 under 35 U.S.C. 103(a) as being unpatentable over DeBoer et al. (US Pub No. 2001/0011740) of record. The Examiner has rejected claim 3 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 as applied to claim 1 above, and further in view of Sun et al. (US Patent 5,841,186) of record. The Examiner has rejected claim 20 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 as applied to claim 14 above, and further in view of Toshio (JP 04-0092423) of record. The Examiner has rejected claim 16 and 19 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 as applied to claim 14 above, and further in view of Slomowitz (US Patent 4,888,088) of record. The Examiner has rejected claims 24, 25, 27 and 28 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 in view of Slomowitz '088 of record. The Examiner has rejected claims 26 and 29 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 and Slomowitz '088 as applied to claim 24 above, and further in view of Hasegawa (US Patent 5,677,015). The Examiner has rejected claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 as applied to claims 1 and 14 above, and further in view of Park et al. (US Patent 5,910,218) of record. The Examiner has rejected claim 31 under 35 U.S.C. 103(a) as being unpatentable over DeBoer '740 and Slomowitz '088 as applied to claim 24 above, and further in view of Park et al. (US Patent 5,910,218) of record.

It is Applicant's understanding that DeBoer et al. alone or in combination with Sun, Toshio, Slomowitz, Hasegawa, and/or Park fails to teach or render obvious Applicant's invention as claimed in claims 1-7, 14-29 and 31. Applicant's teach and claim a method of improving the electrical performance of an as deposited dielectric film so that the dielectric film can be used as an active dielectric, such as a capacitor dielectric or a gate dielectric.

According to Applicant's claimed invention, a dielectric layer is deposited on a substrate. The "as deposited" dielectric is then exposed "to an electrically neutral reactive oxygen atoms"...to improve the electrical performance of the as deposited dielectric. The electrically neutral reactive oxygen atoms are formed by generating an ionized oxygen atoms in a first chamber and then flowing the ionized atoms through a conduit to a section chamber containing a substrate wherein as the ionized atoms travel through the sufficiently long conduit they become electrically neutral reactive oxygen atoms. That is, as the plasma flows through the conduit, the ionized atoms become electrically neutral before reaching the substrate containing chamber and become highly reactive atomic oxygen atoms. Thus, only electrically neutral, highly reactive atomic oxygen atoms flow into the substrate containing chamber. Although the process gas at this point is highly reactive, the mixture is no longer electrically damaging to the substrate or electrical devices, such as transistors formed therein. As shown and illustrated in Figure 4, exposing an as deposited dielectric film to remotely generated reactive oxygen atoms improves the quality and electrical performance of the "as deposited" film (page 22, lines 7-24). Thus, Applicant's teach and claim to expose "an as deposited" dielectric layer to highly reactive oxygen atoms which have been formed by flowing an ionized gas from a first chamber through a conduit where the ionized molecules become electrically neutral and then flowing them into a second chamber containing a substrate to expose the dielectric film.

Applicant does not understand DeBoer et al. to teach exposing an "as deposited" dielectric layer to electrically neutral reactive oxygen atoms formed by ionizing oxygen atoms in a first chamber and flowing them through a conduit to a second chamber containing a substrate and exposing the "as deposited" dielectric layer to the electrically neutral reactive oxygen atoms to improve the electrical characteristics of the dielectric film. Applicant understands DeBoer et al. as describing a method of forming a capacitor having a tantalum oxynitride film. DeBoer teaches first to form a bottom plate electrode 104 (page 2, paragraph 29). A tantalum oxide film, such as a tantalum pentaoxide film (Ta_2O_5) is then formed on the

bottom electrode 104. After formation of the tantalum oxide film, DeBoer teaches to anneal the film in an environment containing oxygen (Page 3, paragraph 33). DeBoer does not teach any where within its four corners that the oxygen anneal occurs in a remote plasma chamber let alone by electrically neutral reactive oxygen atoms formed by flowing ionized ions through a conduit until they become electrically neutral highly reactive oxygen atoms. Next, DeBoer et al. teaches to transform the tantalum pentaoxide film 102 into tantalum oxynitride film ($Ta_xN_yO_z$) film (Page 3, paragraph 34). DeBoer describes several method of converting the tantalum oxide film into a tantalum pentaoxide film, wherein one of which is to anneal the dielectric film "***in a nitrogen atmospheric in the presence of a plasma***." The plasma may be a plasma for enhanced deposition, such as a high density plasma, a radio frequency RF plasma, or electron cyclotron residence (ECR) plasma or remote plasma (Page 3, col. 37). Thus, DeBoer describes that the plasma anneal is for the nitrogen anneal and not the oxygen anneal as claimed by Applicant.

Still further, DeBoer discloses annealing in a nitrogen atmosphere in that "presence of a plasma" indicating that the film is annealed with ionized nitrogen atoms and not electrically neutral atomic species as claimed by Applicant. It is to be appreciated that HDP, RF and ECR plasmas are typically formed in the same chamber in which the substrate to be annealed is located thereby exposing the substrate to an electrical damaging plasma. DeBoer does not appreciate the importance of creating the plasma in one chamber and then flowing the plasma through a conduit until it is electrically neutral and then exposing the dielectric film to the electrically neutral highly reactive oxygen atoms. Still further, the use of a remote plasma does not in of its self indicate that ions formed from that plasma which reach the second chamber are electrically neutral.

In conclusion, DeBoer does describe an oxygen anneal, however, the oxygen anneal is not taught as occurring with remotely generated electrically neutral reactive oxygen atoms as claimed by Applicant. The plasma anneal taught in DeBoer is for the nitrogen anneal and not the oxygen anneal as claimed by Applicant and still further, the nitrogen plasma anneal taught

in DeBoer utilizes ionized atoms, not electrically neutral atoms, to convert the tantalum oxide film into a tantalum oxynitride film.

With respect to the Examiner's position that Applicant's Rule 1.131 Declaration is ineffective because DeBoer claims the same invention as presently claimed by Applicant, Applicant strongly disagrees. First, DeBoer in claim 29, claims additional features and steps not claimed by Applicant namely the introduction of nitrogen into a tantalum oxide film wherein the step of introducing nitrogen comprises the step of annealing in nitrogen atmosphere and a plasma. Additionally, contrary to the Examiner's position, it is Applicant's understanding that dependent claim 29 which lists the different types of plasma is referring to the nitrogen anneal and not the oxygen anneal. This reading is consistent with the teaching of the specification of DeBoer. Still further, and more importantly, no where does DeBoer claim exposing a dielectric film to electrically neutral highly reactive oxygen atoms as claimed by Applicant. Thus, it is Applicant's understanding that Applicant does not claim the same invention as DeBoer. It is Applicant's understanding, therefore, that Applicant's Rule 1.131 Declaration is effective in removing of DeBoer reference.